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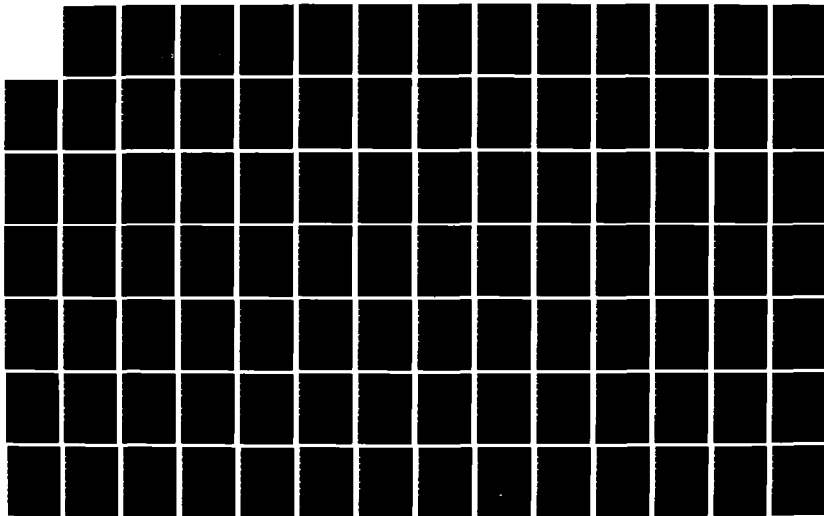
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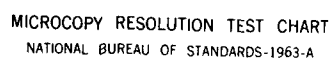
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MEDICAL APPOINTMENT DESK

TELEPHONE TRIAGE

THESIS

Dean M. Wagner, B.S.
Captain, USAF

AFIT/GLM/LSM/85S-80

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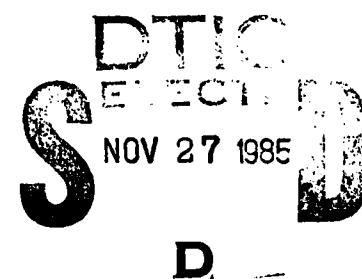
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MEDICAL APPOINTMENT DESK
TELEPHONE TRIAGE

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Dean M. Wagner, B.S.
Captain, USAF

September 1985

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Abstract

The demand for medical care frequently exceeds the ability of Air Force medical facilities to provide it. Appointment systems do little to alleviate this problem.

One way to reduce the problem might be to provide medical appointments on the basis of urgency of need for care, rather than on a first-come, first-served basis as in current systems. The first step in developing such a system would be to determine if medical appointment clerks could accurately diagnose patients telephoning for an appointment.

This thesis explored the possibility of such a system by having medical appointment clerks use a medical diagnosing algorithm to diagnose patients calling for an appointment at the Family Practice Clinic of the Air Force Medical Center at Wright-Patterson AFB Ohio. The the experiment showed that it was possible for appointment clerks to accurately diagnose fifty-nine out of eighty-four patients.

MEDICAL APPOINTMENT DESK TELEPHONE TRIAGE

I. Introduction

General Issue

One of the areas of medical practice that is a source of eternal consternation for both the physician and patient is the appointment and scheduling system(s) used in health care delivery [34:138].

According to Col James A. Wassmund, Director of Medical Administration for Air Training Command, and Col William D. Rasco, Director of Medical Administration for Air Force Logistics Command, a major portion of the complaints received by Air Force medical treatment facilities are on the medical appointment system, primarily centering on patients' inability to obtain timely appointments, if they can get an appointment at all (43, 25). According to Col Wassmund, there are more demands for health care than can be provided with the resources available at most Air Force medical treatment facilities. Under these conditions of limited resources, the Air Force medical treatment facilities' problem becomes one of being able to provide priority care to those patients requiring it the most (43).

Specific Problem

Quality patient care is one of the primary missions of the Air Force Medical Service. Excessive waiting time for medical care reduces patients' perception of the quality of care provided by medical treatment facilities (27:33).

Having to wait excessive amounts of time for medical appointments is recognized by the Air Force Medical Service as one of its significant problems (4:29).

If a patient is unable to obtain a timely appointment, the patient will frequently perceive the quality of care to be substandard (27:33). Patients who perceive they have received substandard medical care are more likely to engage in litigation. This is demonstrated by the recent increase in malpractice lawsuits and subsequent settlements in and out of the military (37:60).

Because excessive patient waiting time for appointments causes a perception of lower quality health care, one possible way to reduce the waiting time for appointments at Air Force medical treatment facilities might be to reduce the size of the patient population. This could be accomplished by refusing care to one or more categories of patients currently eligible for care, such as retired military members or their dependents. But current Air Force Medical Service policy is to try to provide medical services to everyone who is eligible for the services. The Air Force Medical Service views medical care as a vital

benefit earned by all eligible beneficiaries, and will provide medical care whenever possible (43). In the current situation where demand for medical services exceeds the capability of most Air Force medical treatment facilities to provide the service, the problem is then one of insuring that patients receive care when they need it. With numerous patients, the goal of a medical treatment facility should be to provide medical care to the more seriously ill patients first.

In health care, it is desirable to provide medical care first to those patients who need it the most (47:249). The current medical appointment system available at most Air Force medical treatment facilities does not do this, but instead provides appointments on a first-come, first-served basis (43). The result is that the current appointment system available at most Air Force medical treatment facilities is best suited for,

. . . those patients having chronic conditions, requiring follow-up, or having complaints of lesser severity, who are willing to wait for a regular appointment. These patients soon fill the available appointments, leaving no means for patients with minor complaints or illnesses of sudden onset to obtain access to the health care delivery system [3:8-9].

The waiting time for appointments at most Air Force medical treatment facilities is considered to be excessive (24:34). Frequently, so much time elapses between the day the patient makes the appointment and the actual day of the appointment that the patient has either recovered from the

illness or become much more seriously ill (47:251). Many patients who are unwilling to wait will go to the emergency room or use walk-in clinics (3:9).

High usage of these non-appointed services or a high rate of appointments not being kept is generally the result of excessive waiting time for appointments (29:15, 3:3). A study done at the United States Air Force Hospital, Sheppard Air Force Base, indicated that patients who have to wait too long for care at an Air Force medical treatment facility will frequently use non-appointed sources of care, such as the emergency room (29:15). As a result, medical treatment facilities can often judge the reasonableness of their appointment waiting time by observing the frequency of use in the emergency-room (ER), walk-in, non-appointed clinics or the rate of appointments not being kept (3:3, 29:15). According to Col Wassmund, many Air Force medical treatment facilities are experiencing increased use of these non-appointed services, indicating that waiting time for appointments at these facilities is excessive (43). Under the current appointment system available at most Air Force medical treatment facilities, patients with the more urgent need for care are not provided appointments on a priority basis (25).

Because patients are not given appointments based on their urgency of need for care, but rather on the basis

of first-come, first-served, Col James A. Wassmund states:

A method is needed that will allow patients with higher priority to be seen first without forcing them to come to the facility and wait until a doctor can see them. Is it possible for the appointment desk to determine this priority? If it is, we could appoint patients based on how badly they need care [43].

Research Purpose

The purpose of the research presented in this thesis was to determine if the chief medical complaint of patients could be diagnosed when patients telephoned for appointments at a family practice clinic. If such a determination could be made at a satisfactory level of accuracy, an appointment system could, in the future, be designed to use this procedure to provide medical appointments to patients based on how soon they needed care.

Research Questions

The basic question addressed in this research project was whether it was possible for medical appointment clerks to accurately diagnose the chief complaints of patients calling for medical appointments, using only telephone contact with the patients and a medical diagnosing algorithm.

In answering this primary research question, the following sub-questions had to be answered in turn:

1. Was it possible to make diagnoses of the patients' chief complaints, using telephone contact with the patients and the diagnosing algorithm? (See appendices A, B and C for samples of the diagnosing algorithm used in this research).

2. How accurate were the telephone diagnoses of the patients' chief complaints, as compared to the diagnoses made by the medical providers during the actual patients' visits?

3. Which types of diagnoses are more likely to be made accurately using telephone contact with the patients and the diagnosing algorithm, assuming it was possible to make an accurate diagnoses using this method?

4. If it was not possible to make accurate diagnoses of the patients' chief complaints using telephone contact with the patients and the diagnosing algorithm, what types of diagnoses are more likely to be made inaccurately using this method?

5. When it was not possible to make an accurate diagnosis of a patient's chief complaints using telephone contact with the patient and the diagnosing algorithm, what were the probable causes of these difficulties?

6. Assuming it was possible to make accurate diagnoses of patients' chief complaints using telephone

contact with the patients and the diagnosing algorithm, how long does it take to make the diagnoses?

Scope of the Study

The study to achieve the research objectives was conducted using the outpatient appointment desk of the Family Practice Clinic at the United States Air Force Medical Center, Wright-Patterson Air Force Base Ohio. The Medical Center "operates as a military consultation center, direct referral hospital, and an area Medical Center" for Wright-Patterson AFB, the surrounding area, and several smaller Department of Defense medical treatment facilities (26:3). The Medical Center's Family Practice Clinic provides routine, non-specialized, general medicine appointments for active duty personnel, dependents of active duty personnel, retired military personnel, and dependents of retired military personnel, with an average of 57,256 visits annually (26:18). The Family Practice Clinic's appointment desk makes all appointments for its own clinic. The only groups of patients served by the Medical Center that are not served by the Family Practice Clinic are rated personnel, their families, and patients under eighteen years old. Rated personnel and their families receive medical care from the Aerospace Medicine Clinic, which has its own appointment desk. Patients under eighteen years old are treated in the Pediatric Clinic,

which also has its own appointment desk. Patients seeking care from specialty clinics, such as Internal Medicine, must be referred to the specialty clinic by either Family Practice, Aerospace Medicine, or Pediatrics. The Medical Center's non-appointment source for medical care is the Emergency Room.

The Family Practice Clinic at Wright-Patterson Medical Center was selected because:

1. It was accessible to the researcher.
2. The administration of the Medical Center was supportive of the research effort.
3. The supervisor of the Family Practice Clinic agreed to allow the research to be conducted using the Family Practice Appointment Desk.

In addition, the Family Practice Clinic was selected because it provides medical care to a wider range of patients than does either of the other initial entry clinics available in the Medical Center, Aerospace Medicine or Pediatrics. None of the specialty clinics' appointment desks would have been suitable for this research since all patients receiving care from these clinics have already been treated in one of the initial entry clinics: the Family Practice Clinic, the Aerospace Medicine Clinic or the Pediatrics Clinic. These patients have already been diagnosed by a medical provider of the initial entry clinic. Further diagnoses using the diagnosing algorithm would not be needed.

Four appointment clerks participated in the experiment. One clerk was a military medical technician, the remaining three were civilian medical appointment clerks. The clerks' experience in making medical appointments varied from five years to one day. The civilian clerks were all GS-04, and the military clerk was a sergeant (E-4).

All patients who called the appointment desk during the time the study was being conducted were asked to participate. Diagnoses were made on all patients who volunteered to participate in the experiment. Using only volunteers was necessary for four reasons:

1. The Medical Center Administrator requested the researcher obtain patients' permission prior to using the patients in the research.

2. The medical diagnosing algorithm used in the study sometimes used invasive questions into the patients' physical or mental conditions. The ethics of experimentation with human subjects required that the patients' permissions be obtained (9:336).

3. Patients' permissions were also required to obtain their medical records. The records allowed the researcher to determine the diagnoses made by the medical providers during the patients' later visits to the Family Practice Clinic for care. Using patients' medical records

constituted an invasion of personal privacy, requiring the patients' permissions for access to the records (9:336).

4. Air Force Regulation 169-3, Use of Human Subjects in Research, Development, Test and Evaluation, requires patients' permissions be obtained when patients' rights to privacy might be violated (8:3). Access to patients' medical records without permission would be a violation of patients' right of privacy.

Limitations and Assumptions of the Study

Limitations. The major limitation of this study was that it involves a convenience sample. Because this study involved a convenience sample, the results cannot be generalized statistically beyond the patient population serviced by the Family Practice Clinic of the Wright-Patterson Medical Center (44). It was possible that the patient population of the Wright-Patterson Medical Center was not representative of the rest of the Air Force patient population.

Other limitations of the study include the following:

1. The possibility exists that the patient population served by the Family Practice Clinic was not representative of the Wright-Patterson Medical Center patient population. The Family Practice Clinic does not provide care to the entire patient population served by the Wright-Patterson Medical Center. Rated personnel and their families are

treated in the Flight Medicine Clinic and children under eighteen are treated in the Pediatric Clinic.

2. A second limitation of the study was the requirement made by the appointment desk supervisor that the study not be conducted during the appointment desk peak busy periods. It was possible that patients calling in the afternoon, when the study was primarily conducted, are those patients who are not acutely ill and are more willing to wait until afternoon to make their appointments. This would make the sample less representative of the entire patient population.

3. The third limitation of the study was the requirement that patients must volunteer to participate in the study. It was possible that patients refusing to participate in the study may vary significantly from those who agreed to participate (9:299). If patients who refused to participate in the study had been included, the results might have been different.

4. The fourth limitation of the study was the possibility that the medical appointment clerks assigned to the Family Practice appointment desk are not representative of appointment clerks found in other Air Force medical appointment desks.

5. The fifth limitation of the study was the use of Diagnosis Related Groups (DRGs) to relate the diagnoses made by the clerk to the diagnoses made by the provider.

Diagnosis Related Groups are a ". . . definition of case types, each of which could be expected to receive similar amounts of services . . ." (23:15). The problem with using Diagnosis Related Groups in this manner was that the Diagnosis Related Groups were originally developed to group and classify inpatients (23:16). Some studies indicate Diagnosis Related Groups "cannot be applied to populations other than that on which they were originally derived" (23:17). However, without using Diagnosis Related Groups, it would not be possible to objectively relate diagnoses made by the diagnosing algorithm and the diagnoses made by the provider unless the exact same terminology were used to describe both diagnoses. To suggest relationships between the diagnoses when different terminology was used would be relating the diagnoses on a subjective basis. In addition, the medical diagnosing algorithm used in this study does not make as detailed and sophisticated diagnoses as a medical provider makes, since it was written for use by a layman. Medical providers use a much more complex and detailed terminology in describing their diagnoses. Using Diagnosis Related Groups makes it possible to objectively relate diagnoses using a system designed to relate diagnoses together in a common group (23:15).

Assumptions. The assumptions made in this study are:

1. All diagnoses in a Diagnosis Related Group require similar amounts of resources for treatment.
2. Diagnosis Related Groups are sufficiently accurate to be used in determining if diagnoses made using a medical diagnosing algorithm are the same as the diagnoses made by medical providers during actual outpatient visits.
3. The diagnoses made by the medical provider during the actual patient visit are accurate and correct. As such, these diagnoses can be used as the standard against which the diagnoses made by the appointment clerk can be measured.

II. Background and Review of Previous Research

Introduction

The purpose of the research presented in this thesis was to determine if the chief complaints of patients could be accurately diagnosed when the patients telephoned for appointments at a family practice clinic. A review of the available literature did not reveal any evidence of similar research having been conducted either in military or civilian medical treatment facilities. As there was no literature available on similar research, this chapter reviews the subjects that provided the background for this research effort. These areas are:

1. Medical appointment systems.
2. Triage.
3. Medical diagnosing support systems.
4. Telephone triage.
5. Diagnosis Related Groups (DRGs).

Medical Appointment Systems

[Medical Appointment Systems] . . . are established to bring together the patient and provider (at the relative convenience of both) so a health care event can occur [14].

Medical appointment systems are a device for scheduling future activities between patients and providers (19:3). As such, medical appointments are the first step in any non-emergency, non-walkin health-care delivery system (30:407, 27:33). To understand the problems and limitations of medical appointment systems, one must be familiar with the types of medical appointment systems. The following is a review of the literature on medical appointment systems that formed the background for the research effort explained in this thesis.

The medical appointment systems that provide patients access to the health care system vary in complexity. The systems range from the simple, one provider offices with the appointments scheduled on the provider's desk calendar, to complex, manual, paper oriented systems used by large multiple provider practices, to fully computer operated systems found in civilian and military medical treatment facilities (34:138, 19:3-4, 32:151-2, 21:17).

Categories of Medical Appointment Systems. The literature suggests that regardless of the complexity of the operation, medical appointment systems fall into three general categories:

1. The "block" appointment system (24:34).
2. The "conventional" appointment system (29:15).
3. The "wave method" appointment system (30:408, 31:34).

In the "block" appointment system, several patients are given an appointment on the same day at the same time (24:34). For example, in one block system, six patients are given an appointment at the beginning of each hour. When the patients arrive at the medical treatment facility, they then receive care on a first-come, first-served basis (24:34).

In the "conventional" appointment system, the patient is given a specific time and date to be seen, with only that one patient scheduled for the particular date and time (29:15). The duration of the appointments are of specified lengths, commonly 15 to 20 minutes for each patient (29:12-15, 19:3-4,33). This type of appointment system is common in the Air Force (43).

In the "wave method", the objective of the appointment system is to have the medical provider start each hour back on schedule (30:408). For example, to see six patients per hour, per provider, ". . . two patients are scheduled each fifteen minutes up to the three-quarter hour" (30:408). The last fifteen minutes of each hour are not scheduled with patients (30:408). Instead, the last fifteen minutes of the hour are used by the provider to finish the appointments scheduled in that hour (30:408). In addition, the last fifteen minutes of the hour can be used to complete patients' medical records, or catch up on other paperwork (30:407, 31:34).

Types of Medical Appointment Systems. Regardless of the system used, the literature suggests that medical appointment systems fall into two types:

1. Manual, paper oriented systems.
2. Computer oriented systems.

A typical arrangement of a manual appointment system uses pre-printed schedules for each of the medical treatment facilities' providers (29:13). The length of the appointments are predetermined by medical treatment facility policy and are of fixed duration (29:15). Appointment clerks take requests for appointments from patients and manually complete the patient appointment schedule (29:15, 19:4). The providers receive a copy of the appointment schedule and see the patients in the order and times indicated on their schedule (29:12-15, 19:3-4,33). This type of paper oriented, manual system is one method currently used in Air Force medical treatment facilities (43).

The disadvantage of a manual, paper oriented appointment system has been that this type of system tends to be inflexible, time consuming to operate, difficult to update and labor intensive (11:65). The major advantage of a manual, paper oriented system was that it does not require investment in special equipment such as computers (19:33).

The literature suggests that the alternative to a manual, paper oriented system is a computer oriented system. One computer oriented appointment system described in the literature used computers with remote input terminals instead of paper (11:67). The appointment schedules for each provider were developed in the computer's internal memory (34:138). Appointment clerks take requests for appointments from patients and input the requests into the computer system through the remote terminals (11:65). The provider receives either a computer printed copy of the daily patient schedule, or a copy at a remote terminal in the provider's office (34:145, 11:67).

The disadvantage of computer oriented medical appointment systems has been that these systems require special equipment. The advantage of computer oriented appointment systems has been that these systems can be very flexible (11:65). Another advantage of a computer oriented appointment system was that the length of the appointment can easily be varied to suit changes in medical treatment facility policy, changes in medical technology or the individual provider's desires (34:138).

Advantages of Medical Appointment Systems. Studies have shown that medical appointment systems have many advantages over non-appointment systems, such as walk-in clinics or emergency rooms (2:570, 38:104, 32:152).

One advantage of medical appointment systems indicated by the literature was their ability to allow patients access to the medical treatment facility for care at a specified time and date (2:547). This saves the patient's time by not requiring the patient to come to the medical treatment facility and wait to be seen, as would be the case in non-appointment systems (2:570, 38:104, 32:152). According to several studies, patients receiving care in a medical treatment facility using an appointment system spend less time waiting for care than they would in facilities using non-appointment systems (2:547, 32:151, 38:103, 30:409).

Another important advantage of appointment systems that has rarely been mentioned in the literature was that appointments reduce patient contact with other patients (47:251). Less seriously ill patients are not exposed to infection by contagious patients waiting for care, as they would be in a walk-in clinic or emergency room (47:251).

Providers also receive advantages from serving in medical treatment facilities with appointment systems. Appointment systems ". . . allocate the systems most precious resource--the provider's time" (27:33). A good appointment system will allow efficiency in operation and maximum utilization of providers (27:33).

Another benefit to providers of a medical appointment system is that the provider knows who his/her patients will

be and when to expect them. This makes it possible for the patient's medical record to be in the provider's office before the appointment, allowing the provider the opportunity to examine the patient's record before treating the patient. This process makes for an efficient and effective health care encounter (29:15, 19:33, 32:154).

Limitations of Medical Appointment Systems. Although medical appointment systems offer many advantages, studies have shown that medical appointment systems have several limitations (4:29, 5:34). Among the limitations reported by the literature are:

1. Patients perceive that medical appointment systems are the reason that they can not receive the care they want, when they want it (4:29).
2. There are problems with excessive patient waiting time for appointments (4:29).
3. There are problems with unused appointments (4:29).
4. There are the problems of inefficient uses of resources that are created by appointment systems (4:29).
5. There are the problems of the systems being unable to determine which patients need care first (5:34).

Triage

Triage, a French word for "sorting out", earned a place in the English language on the battlefield of World War I. The concept was forged by the enormous numbers of casualties and limited supplies of medication and medical personnel. With one vial of morphine, one medic and 30 wounded, who receives care [28:125]?

The military medical services of the world still use battlefield triage to sort battle casualties (28:125). Military and civilian medical treatment facilities have adapted the triage concept for use when responding to situations producing mass casualties, such as industrial accidents or natural disasters (28:125). Triage has also been used in medical treatment facility emergency rooms to sort patients so that the most seriously ill or injured patients receive care first (45:1528, 47:251). In addition, triage has been used to direct patients to the appropriate provider, or to determine if ". . . the patient's problem requires immediate attention, or if it can wait an hour, a day, a week, or a month" (42:v).

Triage Systems. Triage systems consist of triage categories and the triage officer (28:125). The triage categories group patients by the amount of resources needed to treat the patients' problems, or the patients' urgency of need for care (45:1528, 28:125, 42:v). How the triaging categories are established, what these categories are titled, and what types of patients are included in each category depends upon how the triaging system has been

structured and the purpose of the triage system (42:v, 47:251, 28:125, 45:1528). The individual responsible for assigning patients to the pre-established triage categories has been called the triage officer (28:125, 45:1528). The triage officer has been responsible for:

1. Making sure patients are in the proper triage categories (28:126).

2. Making sure patients receive care in the appropriate sequence (28:126).

3. Keeping track of the conditions of patients waiting for care (28:126).

4. Reassigning patients between categories as the patients' conditions change (28:126).

Triage Categories. The literature suggests that there are three categories of triage systems:

1. Mass casualty/battlefield triage (28:125, 42:vi).

2. Emergency room triage (46, 28:125, 42:iii).

3. Triage in routine care situations (28:125).

Triage systems are necessary on battlefields, in mass casualty situations, in emergency rooms and in routine health care, as studies have shown that it has been impossible to provide immediate access to a provider for every patient who demands it (42:v).

Triage in mass casualty or battlefield situations frequently takes place at the site of the incident (28:125). Resources for treating the patients are limited

to what was brought to the site. Triage in Emergency Rooms occurs when the emergency service is overwhelmed by the number of patients (28:127). Triaging in this situation attempts to treat the most seriously ill or injured patients first (28:126). The triage officer uses physical observation to determine which triage categories to assign the patients (28:126). Patients then receive care based on the triage category to which they are assigned (42:v).

Triage in routine care situations does not usually take place in life or death situations as in battlefield triage or emergency room triage, but instead has the objective of attempting to treat the more seriously ill patients first (47:249, 36:741). Routine care triage and emergency room triage have the same objective of treating the more seriously ill or injured first, but differ in the degree of seriousness of the injuries or illnesses involved.

Triage Officer Categories. The literature suggests that personnel used as triage officers will be either physicians (28:126) or non-physicians (45:1528, 47:249).

Physician Triage Officers. Systems using physicians as triage officers rely on the long training and education physicians receive, assuming this will insure that patients are placed in the appropriate triage category (47:249, 28:127). The advantage of using physicians as triage officers was that their greater experience and

education increases the probability that all aspects of the patients' conditions will be evaluated when assigning patients to triage categories (28:127). The disadvantages of using physicians as triage officers was that studies have shown that using physicians was not cost effective and physicians did not "derive enough professional satisfaction from a steady diet of triaging" (45:1528, 28:127).

Non-physician Triage Officers. The literature divides triage using non-physicians into two categories:

1. Triage using the experience of the triage officer (36:741).

2. Triage using the experience of the triage officer and a triaging algorithm to guide the triage officer (36:741, 45:1528).

Triage using an experienced, non-physician such as a medical technician, as the triage officer, relies on the triage officer's training in triage methods and techniques to ensure patients are assigned to the appropriate triage category (36:741). The advantage of using non-physicians as triage officers was shown in studies as being more cost effective than using a physician triage officer (6:277, 45:1528).

The literature suggests several disadvantages of using non-physicians as triage officers. One disadvantage cited in these cases was that the success of using non-physicians as triage officers was based primarily on the individual

abilities, skills and training of the individual used as the triage officer (45:1528). The literature suggested that when the triage officer was changed due to shift rotation, the quality of the triage would also vary drastically (45:1528). In addition, studies have shown that non-physician triage officers tend to accept the first triaging diagnoses that appears to fit the patient's illness or injury instead of searching for diagnoses that perfectly fit the patient's illness or injury (17:256). Further, the subtle signs of serious illnesses that a physician might have discovered may be missed by the non-physician (47:252). Non-physician triaging officers tend to make satisfactory diagnosis instead of optimal ones (22:995). The literature suggests that this tendency to make sub-optimal triaging diagnoses is undesirable since these diagnoses can adversely impact a patient's health and physical well being (17:263).

Triage using non-physicians armed with a triaging algorithms relies on the experience and training of the triage officer and the quality of the triaging algorithm used to guide the triage officer (45:1528). Studies have shown that using a non-physician and a triaging algorithm was more cost effective than using a physician triaging officer and more effective than using a non-physician triage officer without an algorithm (6:277, 45:1528). In addition, studies have shown that non-physician triage

officers using a triaging algorithm are effective and reliable (45:1528, 18:187, 35:824). The disadvantage of non-physician triage officers using a triaging algorithm was that subtle signs of serious illnesses that a physician might have discovered, may be missed by the non-physician even when a good algorithm is skillfully used (47:252).

Medical Diagnosing Support Systems

The algorithms used in triage function as medical diagnosing support systems. The triaging algorithms are intended to assist the triaging officer in diagnosing patients and assigning the patients to appropriate triage categories. The literature identifies two categories of medical diagnosing support systems:

1. Paper based systems (45:1528, 42:v, 41:31, 1:233).
2. Computer based systems (10:588, 20:468, 48:916, 12:13, 22:995, 16:2028).

Paper Based Systems. Paper based medical diagnosing support systems frequently take the form of published linear algorithms (42:vi, 45:1528, 41:32, 1:233, 46). The algorithms may be used in every-day diagnosing and treatment of patients, as training aids for providers, or as an aid in triage (18:187, 35:824, 33:876). The individual using the algorithm follows the algorithm to its conclusion, asking questions and making observations as directed by the algorithm (45:1528). The advantage of a

paper based medical diagnosing support system was that this type of system does not require special equipment to operate or maintain (46). The disadvantage of paper based systems has been that these types of systems have sometimes been difficult to use because they become very large in the more complex diagnoses of complicated illnesses or injuries (14). For example, the emergency room triage book used by the U.S. Army Hospital at Fort Sam Houston Texas has over 300 pages (46).

Computer Based Systems. Because paper based diagnosing support systems can become so cumbersome, computer based systems are becoming increasingly popular (48:916). The complexity of computer based diagnosing support systems ranges from simple computerization of paper based algorithm systems to systems which use the technology of artificial intelligence (10:591, 16:2021, 48:916, 20:468). Some of the computer based systems which use frames or other artificial intelligence technologies are: Internist-I, ONCOCIN, CADUCEUS, or MYCIN (20:468, 48:916). These "expert systems" attempt to simulate the decision making processes of physicians, or to act as expert consultants (12:3, 48:916).

Computer based diagnosing support systems have been primarily used in the academic environment (48:916). Practical applications of computer based diagnosing support systems are being developed. For instance, the U.S. Navy

has been testing a system to assist corpsman in diagnosing appendicitis aboard patrolling submarines (48:916). Computer based diagnosing support systems have also been successfully tested in emergency rooms to assist in the diagnosing and triage of patients arriving with chest pains and possible heart attacks (10:588).

Studies have shown that the major advantages of a computer based medical diagnosing support systems have been the increased accuracy of diagnoses and the increase in the speed at which the diagnoses can be made when compared to paper based systems (10:588). Studies have shown medical diagnosing support systems to be very useful in the field of medicine (45:1528, 41:31, 10:588, 16:2027).

The major disadvantages of computer based medical diagnosing support systems are the costs of development of the systems and the fact that many systems need large computers on which to run (48:916). The need for large computers has been reduced in scope as medical diagnosing support system programs have been developed that ". . . run on small computers like Pets and Apples . . . (48:916).

Telephone Triage

The literature suggests that telephone triage has taken two forms:

1. Telephone triage using a provider as the triage officer (47:251).

2. Telephone triage using medically trained non-providers as triage officers (36:741).

The two telephone triaging efforts reported in the literature were both undertaken in an attempt to relieve the congestion at the respective medical treatment facilities by reducing the number of patients coming to the medical treatment facility for care when care in a facility was not needed (47:249, 36:741).

Telephone Triage Using Providers. The medical treatment facility using a provider as a telephone triage officer reported that this approach was successful. The facility was able to reduce the number of patients coming to the medical treatment facility for care. Using only telephone contact with the patients, the provider was able to advise on minor problems and illnesses and determine if the patient's problem(s) required medical care at the medical treatment facility (47:249). If the patient's problem was not solved using telephone contact, the provider was able to advise the patients if they needed immediate or routine appointment care (47:251).

Telephone Triage Using Non-providers. The medical treatment facility using a non-provider as a telephone triage officer also reported a success in reducing the number of patients arriving at the medical treatment facility for care when care in a medical treatment facility was not needed (36:741). This facility used a medically

trained clerk who functioned as a central point of contact for patients telephoning the medical treatment facility. The clerk routed the patients' calls to the appropriate medical or administrative service (47:741). The clerk was also able to make minor medical determinations based on his own experience. In addition, if the situation warranted it, the clerk would route the patient's call to a provider who might be able to treat the patient over the phone, or could determine if the patient needed immediate care or a routine appointment (36:741).

Advantages of Telephone Triage. Studies have shown that telephone triage systems are successful in reducing patient utilization of the medical treatment facility (47:253, 36:748). Reducing the utilization of a medical treatment facility by patients who do not really need medical care in a facility means that there are more resources, including time, to treat those patients who do need care in a medical treatment facility.

Limitations of Telephone Triage. The limitation of a telephone triage system was the possibility of missing subtle signs of serious illness that might have been discovered if the patient had been triaged in person (47:252).

Diagnosis Related Groups

One of the basic parts of a triage system is the triage categories. These categories are established to group patients by either similar illnesses or injuries, or by illnesses or injuries requiring similar amounts of resources to treat (42:v, 28:127). The illness or injury classification system used in this research effort was called Diagnosis Related Groups, or more commonly, DRGs.

Diagnosis Related Groups (DRGs), are one of several systems of disease and injury classifications currently used today by medical treatment facilities (23:v, 40:3). These classification systems were developed:

. . . for classification of morbidity and mortality information for statistical purposes, and for the indexing of hospital records by disease and operation, and for storage and retrieval [13:xv].

Diagnosis Related Groups were developed in the late 1960's at Yale University (23:15). The primary objective of the group developing the DRG system at that time was to establish ". . . a definition of [illnesses or injuries], each of which could be expected to receive similar amounts of services from hospitals" (23:15).

The Diagnosis Related Groups version used in this research effort was number 383. This version was a refinement of earlier DRG versions, and was developed in 1981 by the Health Systems Management Group, Yale University, School of Organization and Management, under a

grant from the Health Care Financing Administration (23:15).

Diagnosis Related Groups were used as a classification system in this research effort because DRGs are an accepted illness and injury classification system for many applications (40:1, 39:54, 23:15). For instance, the Tax Equity and Fiscal Act of 1982, uses DRGs as the basis of case mix planning for prospective payment of health care for Medicare recipients (40:1). The literature reports medical treatment facilities using DRGs for budgeting, cost control, treatment pattern analysis, and procedural rate setting (40:1, 39:54). In general, DRGs are a well-recognized and accepted illness and injury classification system for grouping diagnoses (23:15).

DRG Limitations. Although in common use, Diagnosis Related Groups have several limitations. These limitations are:

1. Research has found that DRGs may not be externally valid (23:17).

2. DRGs reflect only the medical technology at the time they were developed (23:16).

3. DRGs group and classify only inpatients, not outpatients (23:16). This should not affect the outcome of this research.

DRG Advantages. Even with these limitations, Diagnosis Related Groups have several advantages over other

diagnoses classification systems. They are:

1. DRGs are conceptually appealing because they attempt to classify diseases and injuries by the amount of resources required for treatment (23:16).

2. The level of aggregation for DRGs results in a manageable number of diagnostic categories when compared to other diagnoses classification systems available today (23:16).

3. "DRGs are organized in a hierarchical manner," allowing more or less abstraction of data as needed (23:16). Classifications can be either very specific, or relatively broad (23:16).

The Diagnosis Related Groups classification system was used since it was felt that the advantages and the commonness of use of DRGs outweigh their limitations for the purposes of this research.

Conclusion

The difficulty that patients of the USAF Medical Service have in obtaining timely appointments is a real and pressing problem (43, 25). A review of the literature has shown that access to medical care is a common problem in both civilian and military medical treatment facilities around the world (4:29, 2570, 19:33, 28:130, 29:15, 32:152, 36:739, 38:103, 43, 25, 47:249). Medical appointment systems have reduced some of the problems of access, but

other problems still exist (4:29, 3:10, 11:67, 15:9, 14, 43). The problem that primarily exists with using medical appointment systems has been that of providing medical care on the basis of urgency of need, not just on a first-come, first-served basis (43, 25, 4:28, 3:5, 24:2, 36:739). The primary difficulty of providing medical appointments based on the patients' urgency of need for care has been the that of determining the chief complaint of patients calling for medical appointments (47:252). The necessary first step in providing medical appointments based on the patients' urgency of need for care is determining the patient's chief complaint before the patient comes to the medical treatment facility for care (42:v).

Triage systems have been effectively used in walk-in and emergency care situations to provide medical care to patients on the basis of urgency of need for care (28:125). But in these cases, the patient must be physically present in the medical treatment facility for evaluation prior to receiving medical care, negating the benefits of appointments (47:251). Medical diagnosing support systems have been successfully tested to support triage of patients physically present in medical treatment facilities (10:588). In addition, where telephone triage has been tested, telephone contact with patients has been successfully used to reduce patient load at medical treatment facilities (36:745).

A search of the literature does not reveal any testing for the feasibility of using clerical personnel who employ a medical diagnosing support system to determine the chief complaint of a patient telephoning for a medical appointment. Experimentation in this area would be a first step in developing a medical diagnosing support system for telephone appointment triage. The need to explore the feasibility of having medical appointment clerks, using a medical diagnosing support system, determine the chief complaint of patients' calling for appointment in a family practice clinic is shown by the lack of previously published research on this subject.

III. Methodology

Introduction

The question addressed in this research project was to determine if it was possible to accurately diagnose the chief complaints of patients calling for medical appointments, using only telephone contact with the patients and a medical diagnosing algorithm. A review of the literature did not reveal any studies in this area. Experimentation was needed to investigate the research question as no data base was available for evaluation or analysis.

Experimental Design and Conditions

This chapter explains the research objectives and the methods used to meet the objectives of this investigation.

Research Objective One. This objective was to determine if it was possible to accurately diagnose patients' chief complaints using only telephone contact with the patients and a medical diagnosing algorithm.

Research Design. To achieve this objective, the research was designed and accomplished as follows:

1. A copy of the medical diagnosing algorithm published in the Family Medical Guide was obtained. This diagnosing algorithm was approved by the American Medical

Association and designed for use by people who are not medically trained (1:66-232). (See Appendix A for an example of this diagnosing algorithm). The algorithm was placed in a three ring binder to make it easier for the medical clerk to use.

2. In addition, two algorithms were written by this researcher to cover the two types of appointments that are common in the Family Practice Clinic:

A. Appointments for refills of medications, previously prescribed by a provider.

B. Appointments for follow-ups on conditions previously diagnosed by a medical provider.

Development of these two algorithms was necessary as there were no algorithms available that addressed these areas. (See Appendices B and C for samples of these algorithms). Both algorithms were approved by the supervisor of the Family Practice Clinic appointment desk, (a registered nurse), and by the Consultant for Medical Appointment Systems to the Air Force Surgeon General, Dr. (Lt Col) James M. Jacobson, but neither was tested prior to data collection.

3. Permission was obtained from the Administrator of the United States Air Force Medical Center, Wright-Patterson Air Force Base Ohio, to use the Medical Center Family Practice Clinic's appointment desk for this research. The medical appointment desk was manned by two

appointment clerks. The telephone was the patients' only access to the appointment desk; therefore, patients are required to use the telephone when making an appointments in the Family Practice Clinic. There were five telephone lines into the desk on an automatic call sequencer. The call sequencer insured patients were served on a first-called, first-served basis. The Family Practice Clinic's appointment system is computerized. The clerks input appointment requests into a computer through remote terminals located in the appointment desk office.

4. Additional permission was obtained from the Medical Center Administrator to allow the researcher access to the medical record department. This made it possible to review medical records of patients who agreed to participate in this research.

5. Permission was obtained from the officer-in-charge of the Family Practice appointment desk to conduct the experiment during the last two weeks of March 1985 and the first two weeks of April 1985.

6. The experiment was conducted during one and one-and-a-half hour period at times mutually agreed upon by the researcher and the appointment desk supervisor. At least one session of the experiment was conducted during each day of the normal duty week (Monday through Friday).

7. The experiment was conducted, except for one day, in the early afternoon to avoid the appointment desk peak

busy periods. The appointment desk supervisor requested that the study not over burden the appointment clerks during their busy periods. Avoiding peak busy periods also kept the time patients waited on hold at a reasonable length while the experiment was being conducted. The one exception to conducting the experiment in the early afternoon was an effort to sample patients calling for appointments first thing in the morning. These patients may differ from patients who wait until afternoons to make an appointment. Morning sample collection was discontinued after one attempt as patient waiting time on hold became excessive while the experiment was being conducted.

8. The appointment clerks of the Family Practice Clinic were provided a copy of the medical diagnosing algorithms described previously.

9. Telephone calls were monitored on an extension telephone while clerks made appointments and diagnosed the patients. Table 1 shows the date and number of patients per day who were diagnosed using telephone contact with the patients and the diagnosing algorithm.

10. Patients calling the appointment desk at the times during which the experiments were being conducted were given medical appointments. Patients were then asked by the appointment clerk if they wished to participate in a study to improve the medical appointment system. If the patient agreed, they were diagnosed by the clerk using the

diagnosing algorithm. Both clerks made appointments and diagnosed patients using the diagnosing algorithm, one waiting to begin making an appointment until the other finished diagnosing. This allowed an opportunity to observe the clerk making the appointment and diagnosing the patient. If it became apparent that appointment calls were stacking up on the sequencer, one clerk was devoted only to making appointments until the number of incoming calls slacked off.

11. Patients who agreed to participate in this research effort were asked why they were calling for an appointment. The patient's reason for calling, such as having a headache, sleeplessness, or need for a refill, was used by the clerk as the basis for locating the appropriate medical diagnosing algorithm. Upon locating the appropriate algorithm, the clerk used the algorithm to diagnose the patient by asking the questions contained in the algorithm and following the algorithm branch indicated by the patients' response.

12. The branches of the algorithm terminated in either a diagnosis or a statement indicating that the algorithm was unable to make a diagnosis from the available information. The diagnosis or the diagnosing failure was then recorded on the data collection sheet shown in Appendix D.

13. One-hundred-ten patients who telephoned the Family Practice Clinic for appointments during the research period were diagnosed using a medical diagnosing algorithm.

14. The clerk's diagnoses was not revealed to the patient in order to avoid alarming the patient if the diagnoses appeared to be of a serious nature.

15. In addition to the diagnosis reported by the appointment clerk, the patient's name and appointment date were also recorded on the data collection sheet. The information was recorded on the data collection sheet from the computer terminal used by the Family Practice Clinic Appointment desk to make appointments and was later used to locate the patients' medical records.

16. The medical records of patients participating in this research were located after the patients were seen in the Family Practice Clinic. The diagnoses made by the providers, as documented in the patients' medical records, were recorded under the "Provider" column of the data collection sheet displayed in Appendix D.

17. When interpretation of diagnoses made by the medical provider during the patients' visit was needed, it was obtained from Dr. (Lt Col) James M. Jacobson, Consultant for Medical Appointment Systems to the Air Force Surgeon General.

TABLE 1
Number of Patients Diagnosed, by Date

<u>Date</u>	<u># Patients Diagnosed</u>
18 March	12
19 March	12
20 March	9
21 March	10
22 March	5
25 March	16
27 March	13
1 April	15
2 April	18
Total	110

Analysis and Decision Rules. In order to determine if it was possible to accurately diagnose a patients' chief complaints using only telephone contact with the patients and a medical diagnosing algorithm, the following analysis and decision rules were applied:

1. The diagnoses made using telephone contact with the individual patients were compared to the diagnoses of the individual patients made by the providers during the actual patient visit. Diagnoses were considered to be the same if:

A. The diagnoses made using telephone contact were stated in the same words as the diagnoses made by the medical provider during the patients' visits and recorded in the patients' medical records. For example, the diagnoses were considered to be the same if the clerk's diagnoses was recorded

as sinusitis and the provider's diagnosis was also recorded as sinusitis.

B. The diagnoses were also considered to be the same if both of the diagnoses were in the same Major Diagnosing Category of Diagnosis Related Groups version 383, even if the two diagnoses were not stated in the same words. The Consultant for Medical Appointment Systems to the Air Force Surgeon General confirmed the assignments of diagnoses to Major Diagnostic Categories.

2. The diagnoses made using telephone contact with the patients and the diagnosing algorithm were not considered to be the same as the diagnoses made by the medical provider during the patients' visits and recorded in the patients' medical records if:

A. They were not stated in the same words or were not in the same Major Diagnostic Category, version 383.

B. Diagnoses made using telephone contact with the patients and the diagnosing algorithm indicated that the patients' needed refills or follow-ups and the patient's medical record indicated that the patients did not receive refills of previously prescribed medication or follow-ups on previously diagnosed illness or injury.

C. The clerk's diagnoses were refills or follow-ups and the patient's medical record indicated that the patients received care for new illness or injuries in addition to the refills or follow-ups.

Research Objective Two. This objective was to determine the level of diagnosing accuracy of patients' chief complaints that could be achieved using telephone contact with patients and a medical diagnosing algorithm.

Research Design. To achieve this objective, the research was designed and accomplished as stated in Research Objective One.

Analysis and Decision Rules. In order to determine the level of diagnosing accuracy of patients' chief complaint that could be achieved using telephone contact with the patients and a medical diagnosing algorithm, the number of accurate diagnoses made by the appointment clerks was compared to the total number of diagnoses that were possible to collect. The total number of diagnoses that were possible to collect was defined as the number of medical records of patients' participating in this research effort that could be located and which indicated the patient attended the appointment scheduled during the research activity. The diagnosing accuracy level was stated as a percent of the total number of diagnoses that were possible to collect.

Research Objective Three. This objective was to determine some of the types of diagnoses that were more likely to be made accurately using telephone contact with patients and a medical diagnosing algorithm.

Research Design. To achieve this objective, the research was designed and accomplished as stated in Research Objective One.

Analysis and Decision Rules. In order to determine some of the types of diagnoses that were more likely to be made accurately using telephone contact with patients, diagnoses that are the same or in the same Major Diagnostic Categories were compared to the number of times that those diagnoses were made by the medical appointment clerk. Diagnosis that were made more than five times were presented as a percent accurate rate. Where a diagnosis was made less than five times, it was possible only to state that in this study, the diagnosis was made accurately at least once.

Research Objective Four. This objective was to determine some of the types of diagnoses that were more likely to be made inaccurately using telephone contact with patients and a medical diagnosing algorithm.

Research Design. To achieve this objective, the research was designed and accomplished as stated in Research Objective One.

Analysis and Decision Rules. In order to determine some of the types of diagnoses that were more likely to be made inaccurately using telephone contact with patients and a medical diagnosing algorithm, diagnoses made by the appointment clerk that are not the same or not in

the same Major Diagnostic Categories as those made by the provider were compared to the number of times that those diagnoses were made by the medical appointment clerk. Diagnosis that were made more than five times were presented as a percent inaccurate rate. Where a diagnosis was made less than five times, it was possible only to state that in this study the diagnosis was made inaccurately at least once.

Research Objective Five. This objective was to determine some of the probable causes of inaccurate diagnoses of patients' chief complaints, using the research method previously described.

Research Design. To achieve this objective, the research was designed and accomplished as stated in Research Objective One. In addition, difficulties encountered by the clerks in using the algorithm were observed and recorded. Causes of inaccurate diagnoses that become apparent from reviewing the patients' medical records were also recorded.

Analysis and Decision Rules. In order to determine some of the probable causes of inaccurate diagnoses of patients' chief complaints by the clerks, some of the causes of inaccurate diagnoses that became apparent during the telephone encounters with the patients' were noted. In addition, clerk's complaints about using the algorithm, or complaints about the patients diagnosed, were

also recorded. This information was used to provide the basis for subjective analysis of some probable causes of inaccurate diagnoses.

Research Objective Six. This objective was to determine how long it takes to diagnose the patients' chief complaints using telephone contact with patients and a medical diagnosing algorithm.

Research Design. To achieve this objective, the research was designed and accomplished as stated in Research Objective One. The medical appointment clerks were timed as they made diagnoses using the diagnosing algorithm. The timing started when the clerk began to ask the patients' permission to be included in the study and ended when the clerk indicated that an end of the algorithm had been reached. Timing began on the seventh session in order that the timing data would only reflect the time it took the clerks to make a diagnoses once they were accustomed to using the algorithm, not how long it took to make diagnoses while learning to use the algorithm.

Analysis and Decision Rules. The amount of time it took the appointment clerks to make individual diagnoses was used to develop an average diagnosing time. In addition, a comparison of the timing of accurate diagnoses to timing of inaccurate diagnoses was made to see if the amount of time taken to make a diagnosis was related to the accuracy of the diagnosis.

Conclusion

The experiment outlined in this chapter was conducted as stated. One-hundred-ten patients were diagnosed by the medical appointment clerks during a four week period. Eighty-four medical records of patients diagnosed could subsequently be located. Observations made during the research were noted on the Data Collection Sheet displayed in Appendix D. The next chapter will present the findings of the research and an analysis of these findings for each of the six research objectives.

IV. Findings and Analysis

Introduction

Experimentation was needed to investigate the research question as no data base was available for evaluation or analysis. This chapter presents the findings of the research. After each finding, the author's analysis will be presented.

Findings and Analysis

Research Objective One. This objective was to determine if it was possible to accurately diagnose patients' chief complaints using only telephone contact with the patients and a medical diagnosing algorithm.

Findings. Of the one-hundred-ten patients diagnosed, eighty-four medical records could be located after an extensive search. Fifty-nine of the medical records indicated that the diagnoses made using telephone contact with the patients were accurate. Of the fifty-nine accurate diagnoses, forty-two of the diagnoses were stated in the same words by both the clerk and the provider (See Table 2). Seventeen of the accurate diagnoses were not stated in the same words, but were in the same Major Diagnosis Category of Diagnosis Related Groups version 383.

TABLE 2
Diagnosis Data

Total Contacts	110
Usable Diagnoses	84
Accurate Diagnoses	59
Inaccurate Diagnoses	25

These diagnoses were also considered to be the same. Table 3 lists the diagnoses that were made accurately at least once, the number of accurate diagnoses for that particular diagnoses, and the percent accurate rate. Table 4 lists Major Diagnosis Categories in which the clerk made an accurate diagnosis at least once. The table also shows the number of diagnoses made in each Major Diagnosis Category and the number of accurate diagnoses in that category. Table 4 totals do not add up to fifty-nine since refills, follow-ups and certain other outpatient visit categories are not grouped in Major Diagnosis Categories. Appendix F contains a complete display of all accurate diagnoses by case, including the data collection date, patient appointment date, clerk diagnosis, provider diagnosis, and the Major Diagnosis Category of the provider's diagnosis.

Analysis. Based on the data from the findings, it appears that it was possible for a non-physician (clerk), using a medical diagnosing algorithm, to

TABLE 3

Accurate Diagnoses

<u>Diagnosis</u>	<u>Times Diagnosis Made</u>	<u>Times Diagnosis Accurate</u>	<u>Percent Accurate</u>
Arthritis	4	2	50
Basal Cell Carcinoma	1	1	100
Blurred Vision	1	1	100
Boil	1	1	100
Carpal Tunnel Syndrome	1	1	100
Cataract	1	1	100
Cold	2	2	100
Follow-up	19	17	89
Gastritis	1	1	100
Groin Irritation	1	1	100
Heartburn	1	1	100
Hearing Loss	1	1	100
Hemorrhoids	3	1	33
High Blood Pressure	1	1	100
Influenza	1	1	100
Kidney Infection	2	2	100
Middle Ear Infection	1	1	100
Muscle Strain	4	4	100
Rectal Rash	1	1	100
Refill	14	12	86
Sinusitis	2	2	100
Tendonitis	2	1	50
VD Warts	1	1	100
X-Ray Read	1	1	100
Wart	1	1	100

Total Accurate Diagnoses: 59

Total Usable Diagnoses: 84

Percent Accurate: 70

TABLE 4

Accurate Diagnoses By
Major Diagnosis Category

<u>Major Diagnosis Category</u>	<u>Times Diagnosis Made</u>	<u>Times Diagnosis Accurate</u>
# 4 Malignant Neoplasm of the Skin	1	1
#12 Benign Neoplasm of Other Sites	1	1
#23 Diseases of the Eye	4	3
#24 Diseases of Ear & Mastoid Process	3	2
#25 Hypertensive Heart Diseases	1	1
#37 Acute Upper Respiratory Tract Infection and Influenza	2	2
#38 Other Diseases of the Upper Respiratory Tract	4	3
#45 Upper Gastro-Intestinal Diseases Except Gastric & Peptic Ulcers	2	2
#49 Diseases of the Anus	2	2
#54 Diseases of the Kidney & Ureter	1	1
#56 Cystitis & Other Urinary Diseases	2	1
#58 Diseases of the Male Reproductive System	1	1
#65 Diseases of the Skin & Subcutaneous Tissue	2	2
#66 Arthritis	4	2
#69 Other Disease of the Musculo- skeletal System	1	1
#77 Dislocations & Other Musculo- skeletal Injuries	6	4

Total Diagnoses in Major Diagnosis Categories: 29
Follow-ups and Refills: 29
Other Diagnoses not in a MDC: 1
Total Accurate Diagnoses: 59
Total Usable Diagnoses: 84
Percent Accurate: 70

accurately diagnose patients requesting appointments in a family practice clinic using only telephone contact with the patients. In fifty-nine of the eighty-four usable cases (seventy percent), an accurate diagnosis was made.

Research Objective Two. This objective was to determine the level of diagnosing accuracy of patients' chief complaints that could be achieved using telephone contact with patients and a medical diagnosing algorithm.

Findings. The level of diagnosing accuracy of patients' chief complaints that could be achieved using telephone contact with patients and a medical diagnosing algorithm was found to be seventy percent in this experiment. The level of diagnosing inaccuracy was determined to be thirty percent. Of the fifty-nine accurate diagnoses, both clerk and provider used the same wording to describe their diagnoses in forty-two of the diagnoses. This equates to a seventy-one percent of the accurate diagnoses being made in the same words by both the appointment clerk and the medical provider. Twenty-nine percent of the fifty-nine accurate diagnoses were not in the same wording, but still in the same Major Diagnosis Category. This means that seventeen of the clerks' accurate diagnoses did not use the same words, but still made the same diagnoses.

Analysis. The seventy percent diagnosing accuracy level means that further research into using

appointment clerks to pre-diagnose patients calling for medical appointments is justified, according to Col James A. Wassmund, Director of Medical Administration for Air Training Command (43).

The seventy percent accuracy level also corresponds favorably with a diagnosing accuracy level of eighty-four percent reported in the literature where non-providers used algorithms and face-to-face contact with patients to make diagnoses (46:1528). In the case cited in the literature, the individuals diagnosing patients had the additional advantage of being able to physically observe patients and to perform tests on the patients. In this study, the individual diagnosing patients had only the patients' response to diagnosing questions from which to make the diagnosis. Any physical observations had to be undertaken by the patient, and reported to the clerk over the telephone.

In the cases where the telephone diagnoses were inaccurate, the diagnosis made by the clerk appears to be, in general, the same severity, or slightly more severe, than the diagnoses made by the providers. This means that if the clerks' diagnoses were in error, they appeared to err on the side of conservatism. In no instances in this study did a telephone diagnoses indicate a minor problem while the subsequent visit to the medical treatment facility resulted in a diagnoses of an acute, life

threatening illness or injury. It appears that if patients were provided appointments based on their urgency of need for care as determined by the appointment clerk, the patients would more likely be given a earlier appointment based on the more serious diagnoses. This should avoid the problem of patients becoming seriously ill because they were diagnosed by the clerk as having less serious illnesses and thus waited too long for an appointment. With the current first-come first-served appointment system, it is a random occurrence if the patient gets an early appointment.

Research Objective Three. This objective was to determine some of the types of diagnoses that were more likely to be made accurately using telephone contact with patients, and a medical diagnosing algorithm.

Findings. There were eight-five cases were the clerks' diagnoses could be confirmed. The eighty-five cases can be grouped into thirty-five individual diagnoses. Of the thirty-five individual diagnoses made in this study, twenty-five of the diagnoses were made accurately at least once. Ten of the diagnoses made by the clerks were never accomplished accurately. Five illnesses were accurately diagnosed by the clerk at certain times, while at other times, the clerks could not accurately diagnose the same illnesses. Table 3 lists all accurate diagnoses made by the clerks during this experiment.

Analysis. This experiment resulted in a broader range of diagnoses than expected. As a result, the sample size for the individual accurate diagnosis was too small to make a valid inference about which diagnoses were more likely to be made accurately. Only two diagnoses were made more than five times (refills, fourteen, and follow-ups, nineteen). The remaining diagnoses were distributed as follows:

1. Diagnoses made four times: arthritis and muscle strain.
2. Diagnoses made three times: hemorrhoids.
3. Diagnoses made twice: cold, kidney infection, sinusitis, and tendonitis.
4. Diagnoses made once: See Tables 3 and 5.

Twelve of the fourteen diagnoses for refills were accurate, making an accuracy level of eighty-six percent for refills. Of the nineteen diagnoses for a follow-up, seventeen were accurate, which gives an eighty-nine percent accuracy level. From a broad observation of the data, it appears that diagnoses with clear cut indications are more likely to be made accurately, while those diagnoses where the symptoms are more nebulous are likely to be made less accurately.

An example of a straightforward diagnosis was of kidney infection. This diagnosis was made twice by the clerks and was accurate both times. The symptoms for kidney infection

are manifested primarily in a pain the kidney area and was not easily confused with other diagnoses. A less straight forward diagnosis was that of hemorrhoids. This diagnosis was made three times by the clerks and was wrong twice. The symptoms of a herniated rectum, for instance, can easily be mistaken for that of hemorrhoids.

For the individual diagnoses, other than refills or follow-ups, it was only possible to state that the diagnoses listed in Table 3 were made accurately at least once in this study.

Research Objective Four. This objective was to determine some of the types of diagnoses that were more likely to be made inaccurately using telephone contact with patients and a medical diagnosing algorithm.

Findings. Table 5 lists all inaccurate diagnoses made during this experiment. There were a total of thirty-five diagnoses made during this study. Fifteen of the diagnoses were made incorrectly at least once.

Analysis. The sample size for the individual inaccurate diagnoses was too small to make a valid inference of which diagnoses were more likely to be made inaccurately. For the individual diagnoses, other than refills or follow-ups, it was only possible to state that the diagnoses listed in Table 5 were made inaccurately at least once in this study. Table 6 lists Major Diagnosis Categories in which a diagnoses was made inaccurately at least once.

TABLE 5
Inaccurate Diagnoses

<u>Diagnosis</u>	<u>Times Diagnosis Made</u>	<u>Times Diagnosis Inaccurate</u>	<u>Percent Inaccurate</u>
Arthritis	4	2	50
Bronchitis	1	1	100
Corns	1	1	100
Diabetes	1	1	100
Follow-up	18	2	11
Gastritis	1	1	100
Gout	1	1	100
Hemorrhoids	3	2	67
Hyperthyroidism	1	1	100
Hodgkins Disease	1	1	100
Meningitis	1	1	100
Pinched Nerve	1	1	100
Pulmonary Edema	1	1	100
Refill	14	2	14
Tendonitis	2	1	50
Algorithm Failure	6	6	--

Total Inaccurate Diagnoses: 25
Total Usable Diagnoses: 84
Percent Inaccurate: 30

TABLE 6

Inaccurate Diagnoses By
Major Diagnosis Category

<u>Major Diagnosis Category</u>	<u>Times Diagnosis Made</u>	<u>Times Diagnosis Inaccurate</u>
#14 Diabetes	1	1
#15 Nutritional & Other Metabolic Diseases	1	1
#18 Neuroses	1	1
#21 Diseases of the Central Nervous System	1	1
#23 Diseases of the Eye	4	1
#24 Diseases of the Ear & Mastoid Process	3	1
#38 Other Diseases of the Upper Respiratory Tract	4	1
#47 Hernia of the Abdominal Cavity	1	1
#52 Diseases of the Gallbladder & Bile Duct	1	1
#56 Cystitis & Other Urinary Diseases	2	1
#59 Diseases of the Female Reproductive System	1	1
#66 Arthritis	4	2
#68 Diseases of the Bone & Cartilage	1	1
#77 Dislocations & Other Musculo Skeletal Injuries	6	2
#83 Special Admissions & Examination	1	1

Total Diagnoses in Major Diagnosis Categories: 17

Follow-ups and Refills: 4

Provider did not make a diagnosis: 4

Total Inaccurate Diagnoses: 25

Total Usable Diagnoses: 84

Percent Inaccurate: 30

Research Objective Five. This objective was to determine some of the probable causes of inaccurate diagnoses of patients' chief complaints using telephone contact with the patients and a medical diagnosing algorithm.

Findings. There where ten cases where the diagnoses made by the clerks were wrong. Table 7 shows these incorrect diagnoses and the correct diagnoses made by the providers. There were four cases where the clerks made a diagnosis but the provider decided to delay making a diagnosis until some future appointment. These cases are shown in Table 8.

In addition, there were six instances where the algorithm terminated without a diagnosis. These cases are shown in Table 9, along with the diagnoses made by the providers during the patients' actual visits.

There were six cases where it was apparent that a miscommunication between the clerks and the patients resulted in inaccurate diagnoses. These cases are shown in Table 10.

Analysis. The data from Table 6 illustrates that illnesses or injuries with more complicated symptoms are more likely to be diagnosed inaccurately. In one instance, the clerk made a diagnosis which was of a chronic nature and the diagnosis made by the provider was acute.

Table 7

Inaccurate Clerk Diagnoses vs
Provider Diagnoses

<u>Clerk Diagnoses</u>	<u>Provider Diagnoses</u>
Arthritis	Urinary tract Infection
Arthritis	Osteoporosis
Bronchitis	Diabetes
Gout	Osteoporosis
Hemorrhoids	Hernia
Hyperthyroidism	Obesity
Lymphoma	Muscle strain
Meningitis	Strained Torticollis
Pinched Nerve	Cervical Lesion
Pulmonary Edema	Sinusitis

Table 8

Inaccurate Clerk Diagnoses Where
Provider Did Not Make A Diagnosis

<u>Clerk Diagnoses</u>	<u>Provider Diagnoses</u>
Diabetes	Undetermined
Hemorrhoids	No Diagnosis
Tendonitis	No Diagnosis
Algorithm Failed	No Diagnosis

Table 9

Algorithm Failures

<u>Clerk Diagnoses</u>	<u>Provider Diagnoses</u>
Algorithm Failure	Blephoritis
Algorithm Failure	Follow-up
Algorithm Failure	Gallstones
Algorithm Failure	Hearing Loss
Algorithm Failure	Multiple Sclerosis
Algorithm Failure	No Diagnosis

Table 10

Other Diagnosing Difficulties

<u>Clerk Diagnoses</u>	<u>Provider Diagnoses</u>
Corns/Warts	Sterilization
Follow-up	Physical
Follow-up	Patient Wanted Help
	Filling Out License Form
Patient Unresponsive	Viral Syndrome Bursitis
Refill	Forgetfulness
Refill	EKG for Civilian
	Weight Loss Clinic

This was the case where the clerk's diagnosis was bronchitis, and the provider's diagnosis was diabetes.

In the four instances where the clerk made a diagnosis, but the provider did not, no clear inferences could be made. From the patients' medical records, it appeared that the provider decided to delay making a diagnosis and asked the patient to schedule a follow-up. In two cases, it appeared that the provider needed time to receive the results of diagnostic test, and in the other two cases, it appeared the provider wanted to see if time would bring the patients' symptoms into sharper focus or cure the patients' problems.

In the six cases where the diagnosing algorithm failed to make a diagnoses, future studies could possibly develop diagnosing algorithms that would cover multiple sclerosis and blephoritis. In the remainder of the cases where the algorithm proved to be insufficient, there were actually algorithms for the diagnoses that were made by the provider. In these instances, the algorithm failure could be a result of the clerk being unable to follow the algorithm or the patient being unable to provide sufficient information for the clerk to use the diagnosing algorithm, rather than there not being an algorithm available for the patients' symptoms.

Observations made during the experiment provide insight into the causes of the inaccuracies displayed in

Table 10. In one case, the patient was lathergic and unwilling or unable to answer the clerk's questions accurately. There was one case where the clerk did not attempt to diagnose the patient because the patient spoke very little English. From this, it was apparent that language difficulties may complicate making accurate diagnoses when using telephone contact with patients.

An additional problem that can be observed from Table 10, is that it appears patients may mislead the clerk on their reasons for requesting an appointment. This may occur because the patient was embarrassed about the reason for wanting an appointment. Such may be the case of the patient who sought sterilization. Another reason for patients to be misleading may be in an effort to receive services that are not normally provided. For instance, the Family Practice Clinic does not provided routine physicals or EKGs on demand. Two patients seeking these services were informed by the appointment clerks that these services were not available. One patient then requested an appointment for a follow-up, and the other patient requested an appointment for a refill. These instances were documented during the clerk diagnosing phase of the research because of the unique nature of the initial requests. The medical records of these patients indicated that when they saw the provider, they reverted back to their true reason for desiring an appointment.

The literature suggests that patients seeking medical appointments occasionally do not need medical treatment but instead view the medical treatment facility as a source of non-medical expertise and assistance (36:741). In one such situation in this study, the patient told the appointment clerk that he needed a refill, but when the patient was seen in the Family Practice Clinic, he asked the provider to assist him in filling out a license form.

From the data presented, it appears that there are many causes of inaccurate diagnoses. These causes appear to fall into four categories:

1. Algorithm insufficiencies.
2. Clerks' inability to properly use the diagnosing algorithm.
3. Patients' inability to provide sufficient information for clerks to make diagnoses.
4. Patients providing false or misleading information to the appointment clerks.

These four causes of inaccurate clerk diagnoses were responsible for the twenty-five inaccurate diagnoses made by the clerks, and the resulting thirty percent diagnosing inaccuracy level discovered in this research.

Research Objective Six. This research objective was to determine how long it takes to diagnose the patients' chief complaints using telephone contact with patients and a medical diagnosing algorithm.

Findings. There were thirty-two timings of the confirmable diagnoses. The time it took to make a diagnoses ranged from 0.30 minutes to 3.70 minutes. The mean diagnosing time was 1.48 minute with a standard deviation of 0.82 minutes. There were twenty-two timings of diagnoses where the diagnoses were determined to be accurate. The time it took to make an accurate diagnoses ranged from 0.30 minutes to 2.40 minutes. The mean diagnosing time for accurate diagnoses was 1.19 minutes with a standard deviation of 0.62 minutes. There were also ten timings of diagnoses where the diagnoses were determined to be inaccurate. The time it took to make an inaccurate diagnoses ranged from 0.60 minutes to 3.70 minutes. The mean diagnosing time for inaccurate diagnoses was 2.12 minutes with a standard deviation of 0.87. Table 10 presents the timing data.

Analysis. From the data presented, it appears that it takes an average time of 1.48 minutes for a medical appointment clerk to make a diagnosis using a diagnosing algorithm and telephone contact with the patient. It would be up to the management of the appointment desk to determine if the extra time needed to diagnose patients is justified by the benefits of providing appointments based on the patients' urgency of need for care. The time it took to make a diagnosis was overrepresented because the figures include the time the clerk took to ask the patient

if they would participate in the study. In actuality, the average time it takes an appointment clerk to pre-diagnose is less than 1.48 minutes.

From reviewing the data, it appears that the time it takes to make a diagnoses was inversely related to the accuracy of the diagnoses. It appears that the more accurate diagnoses take a shorter time to make, while inaccurate diagnoses take a longer time to make. The data suggests that this was because accurate diagnoses result from clear cut symptoms that are easy to diagnose using the algorithm. The inaccurate diagnoses tend to be of a more complicated nature than accurate diagnoses, and resulted in the longer diagnosing time because the clerks spent more time searching for the appropriate algorithm and algorithm branch.

Summary of Findings

The results of conducting this research are as follows:

1. Out of one-hundred-ten patients initially diagnosed by the clerks, medical records for eighty-four could be located. Fifty-nine of the clerks' diagnoses were accurate. From this data, it appears that it is possible for a clerk to accurately pre-diagnose patients calling for an appointment.

2. The fifty-nine accurate diagnoses out of eighty-four confirmable diagnoses corresponds to a seventy percent diagnosing accuracy level. It appears from these data that further research into using clerks to pre-diagnose patients is warranted.

3. The sampling of individual diagnoses was too small to be able to realistically predict diagnoses that are more likely to be made accurately. The data does suggest that simpler, more straightforward diagnoses are more likely to be made accurately.

4. The sampling of individual diagnoses was too small to be able to realistically predict diagnoses that are more likely to be made inaccurately.

5. There appear to be four causes of clerks making inaccurate diagnoses:

A. The algorithm does not cover the patients' symptom(s).

B. The clerks are not able to properly use the diagnosing algorithm.

C. Patients can not provide the clerks with sufficient information for the clerk to make a diagnoses.

D. Patients provide false or misleading information to the appointment clerks.

6. The average time it take the appointment clerk to make a diagnoses using the algorithm is 1.48 minutes. It would be up to the management of the appointment desk to

determine is the extra time needed to diagnose patients is justified by the benefits of providing appointments based on the patients' urgency of need for care.

The next chapter will present a brief synopsis on some of the results of the study, areas where the results of the study could be put to use by medical treatment facilities, and recommendations for extension of this study.

Table 11

Diagnosing Time

Algorithm <u>Run Time</u>	Acc <u>Diag</u>	Inacc <u>Diag</u>	Clerk Diagnoses <u>(Provider Diagnoses)</u>
1.50		x	Algorithm Fail (No Diagnosis)
1.70		x	Algorithm Fail (Gallstone)
3.70		x	Bronchitis (Diabetes)
3.00		x	Corns (Sterilization)
2.80		x	Hyperthyroid (Obesity)
1.90		x	Patient Unresponsive (Bursitis)
2.20		x	Pinched Nerve (cervical lesion)
.60		x	Refill (EKG)
2.00		x	Refill (Forgetfulness)
1.70		x	Tendonitis (No Diagnosis)
1.20	x		Basal Cell Carcinoma
2.40	x		Blurred Vision
1.50	x		Boil
.30	x		Cataract
2.20	x		Cold
2.20	x		Cold
.70	x		Follow-up
.90	x		Follow-up
.50	x		Follow-up
.90	x		Follow-up
.90	x		Follow-up
1.40	x		Follow-up
1.10	x		Gastritis
2.30	x		Muscle Strain
1.80	x		Rectal Rash
1.00	x		Refill
.60	x		Refill
1.20	x		Refill
.80	x		Refill
.40	x		Tendonitis
.90	x		Wart
1.00	x		X-Ray Read

Mean = 1.48 Standard Deviation = .82
 Timings Of Accurate Diagnoses = 22
 Timings Of Inaccurate Diagnoses = 10
 Timings On Confirmable Diagnoses = 32

V. Conclusions and Implications

Introduction

This chapter presents the significant results of this research, practical implications of these results, and recommendations for future studies.

Significance of Results

There are three significant results of this research:

1. It appears that it is possible for medical appointment clerks using a diagnosing algorithm to accurately diagnose patients telephoning for an appointment at the Family Practice Clinic of the USAF Medical Center Wright-Patterson AFB Ohio. The level of diagnosing accuracy achieved in this research was seventy percent. This means that out of eighty-four diagnoses made by the clerks fifty-nine were accurate. According to Col James A. Wassmund, Director of Medical Administration for Air Training Command, this level of diagnosing accuracy justifies additional research into the area of using clerks to diagnose patients as an integral part of an appointment system that would provide appointments based on a patient's urgency of need for care (43).

The accuracy of clerks pre-diagnosing patients seems to be limited by the algorithm used in the study, the clerks' ability to use the algorithm, the difficulty of obtaining sufficient information from patients in order for the clerk to make a diagnoses, and patients' providing misinformation to the appointment clerk.

The significance of this study's results are that the data suggests that it is possible for clerks, who are not medically trained, to accurately diagnose patients' chief complaints when using only telephone contact with the patients and a medical diagnosing algorithm. Because of these findings, it may be possible to develop medical appointment systems which provide appointments to patients based on the patients' urgency of need for medical care.

The seventy percent accuracy level for diagnoses suggests that continued research into this method is warranted. The current appointment systems provides timely appointments on a random basis. Under the current appointment system used in the Family Practice Clinic some patients with an urgent need for medical care must wait longer for an appointment than less seriously ill patients. A patient's waiting time depends upon when the patient calls for an appointment and when the next appointment is available. Because of this, patients who should not wait may be forced to and, as a result, may become more seriously ill while waiting to get an appointment.

Patients unwilling to wait may use non-appointment services such as the Emergency Room (47:251, 3:3).

With the current, system there is no established method to determine how urgently the patients need care. Patients are assigned to providers based on the patient's preference or which provider has the next open appointment. There is no attempt to assign more complicated illnesses or injuries to physicians. Instead, patients with complex problems may be assigned to a non-physician such as a physician assistant or nurse practitioner. Because these providers are not as highly trained and educated as physicians, they are not allowed by regulation to treat a wide range of medical problems. (7:12). If the patient's problem can not be treated by the physician assistant or nurse practitioner, the patient is given an appointment at a later date with a physician (7:12). Having the patient be seen in multiple visits for the same difficulty does not appear to be an effective use of providers' or patients' time.

2. The study showed that it took an average of 1.48 minutes for the clerk to make a diagnosis using a medical diagnosing algorithm. It would seem that for patients, the benefits of receiving timely appointments would outweigh the burden of waiting an additional time in the telephone queue for an appointment while patients are being pre-diagnosed by the appointment clerks. Further, the

patient may receive additional benefits by being assigned to the appropriate provider during their first appointment rather than having to return for a second appointment because the first provider was not able to treat their medical problem.

The medical treatment facility would benefit from more efficient use of their provider resources. It might be possible to avoid multiple visits by patients if they could be assigned to the appropriate provider on the first visit. In addition, appointment lengths might be customized to the patients' need for care, which would even further enhance the efficient use of the providers' time.

3. The study showed that diagnoses made by telephone will not be one-hundred percent accurate. This fact means that if a medical facility would adopt clerks' pre-diagnoses as the basis for an urgency of need for care appointment system, there will be times when patients would be given inappropriate appointments. However, this method of scheduling appointments with its inaccuracies would still have a greater chance of matching patients to the appropriate provider or giving patients appointments based on their urgency of need for care than does the current system. Also, it appears that the benefits of having the majority of the patients seen at the appropriate appointment time and by the correct type of provider would outweigh the disadvantages of having a few inappropriately

appointed patients. Better diagnosing accuracy levels could be achieved through expanded and improved diagnosing algorithms and additional training of appointment clerks.

Practical Implications

There are several areas which can benefit from this study. First, it may be possible to develop an algorithm based appointment system which provides appointments based on patients' urgency of need for care. By facilitating the development of an urgency of need appointment system, the demands for care placed on a medical treatment facility might be reduced. Such a system is described in the literature as one in which patients with simple urgent problems are given short, same day appointments (5:35). The downfall of such systems in the past has been that the appointment clerks making the urgent appointment had to rely on their own expertise when deciding if patients calling for an urgent appointment actually needed one (5:36). A medical appointment clerk using a medical diagnosing algorithm would overcome this problem, as the success of the system would not rely entirely on the past medical experience of the appointment clerk. The seventy percent accuracy level of this research experiment supports the belief that such a system could be effective. Algorithms could be developed to encompass the illnesses and injuries that would benefit the most from an urgency of

need appointment system.

Another practical benefit of being able to accurately diagnose patients calling for appointments might be that patients with non-urgent problems could be given an appointment further in the future. This would leave appointments available early in the schedule for patients with more urgent problems. A system might work as follows: if appointments are made for three weeks in the future, the first two weeks' appointments could be reserved for patients with the more urgent need for care. Patients with the less urgent need for care would be given only appointments in the third week. Subsequent follow-ups by the appointment desk staff to the non-urgent appointments may show that the patients no longer need the appointments. These appointments could then be given to other patients.

The following is an example of how such a system may be useful. In this study a patient wanted an appointment to have an X-Ray read for a job application. This patient was given a the next available appointment, which happened to be the next day because an appointment had just opened up due to a patient cancellation. Any patients with a more urgent need for care had to wait for the next available appointment, which was nine days away. Subsequent review of the patient's medical record did not reveal any reason why that patient could not have waited more than two weeks for an appointment to have the X-Ray read. If the Family

Practice Clinic had been using the system explained previously, this patient would have been given the next available appointment in the third week. The open appointment would have been given to the next patient telephoning with an urgent need for care. The division between what constituted an urgent problem and what was not an urgent problem could be developed by the individual medical treatment facility.

Since this study illustrates that it is possible for medical appointment clerks to accurately diagnose a patients' chief complaints at seventy percent accuracy, it may be possible to establish a scheduled time length for appointments based upon the clerks' diagnoses. The appointment system currently found in the Family Practice Clinic of Wright-Patterson Medical Center uses pre-established appointment lengths of fifteen minutes and twenty minutes. These appointment lengths are based upon the preference of the provider and are not to be changed by the appointment clerk without permission. There are times when the established appointment length is too short and other times when it is too long. As an example, fifteen minutes for a refill might be too long, leaving the provider with empty time if another patient is not waiting. For more complicated illnesses or injuries, fifteen minutes might be too short, causing the appointment to run over into the next one and making every other appointment late

for the rest of the day. The current computerized appointment system could be modified so that the appointment clerk could adjust the length of the appointment to suit the projected diagnosis.

Recommendations for Follow-on Studies

The first area recommended for follow-on study is to duplicate the research at other times of the day, using the other two initial entry appointment desks, Aerospace Medicine and Pediatrics, in addition to the Family Practice appointment desk. This would provide the basis for analysis of the entire Wright-Patterson Air Force Base population, and provide the ground work for studies at other locations.

Follow-on studies at other Air Force installations to determine if similar results are obtained are also recommended.

Another possible area for future research is a study on the effectiveness of using a computer oriented diagnosing algorithm instead of the paper oriented system used in this research. The purpose of this research might be to study if computer oriented diagnosing algorithms increase the accuracy of telephone diagnoses made by appointment clerks.

Col James A. Wassmund, Director of Medical Administration for Air Training Command, suggests that a

follow-on study be designed to encompass a larger patient population and a more comprehensive medical diagnosing algorithm.

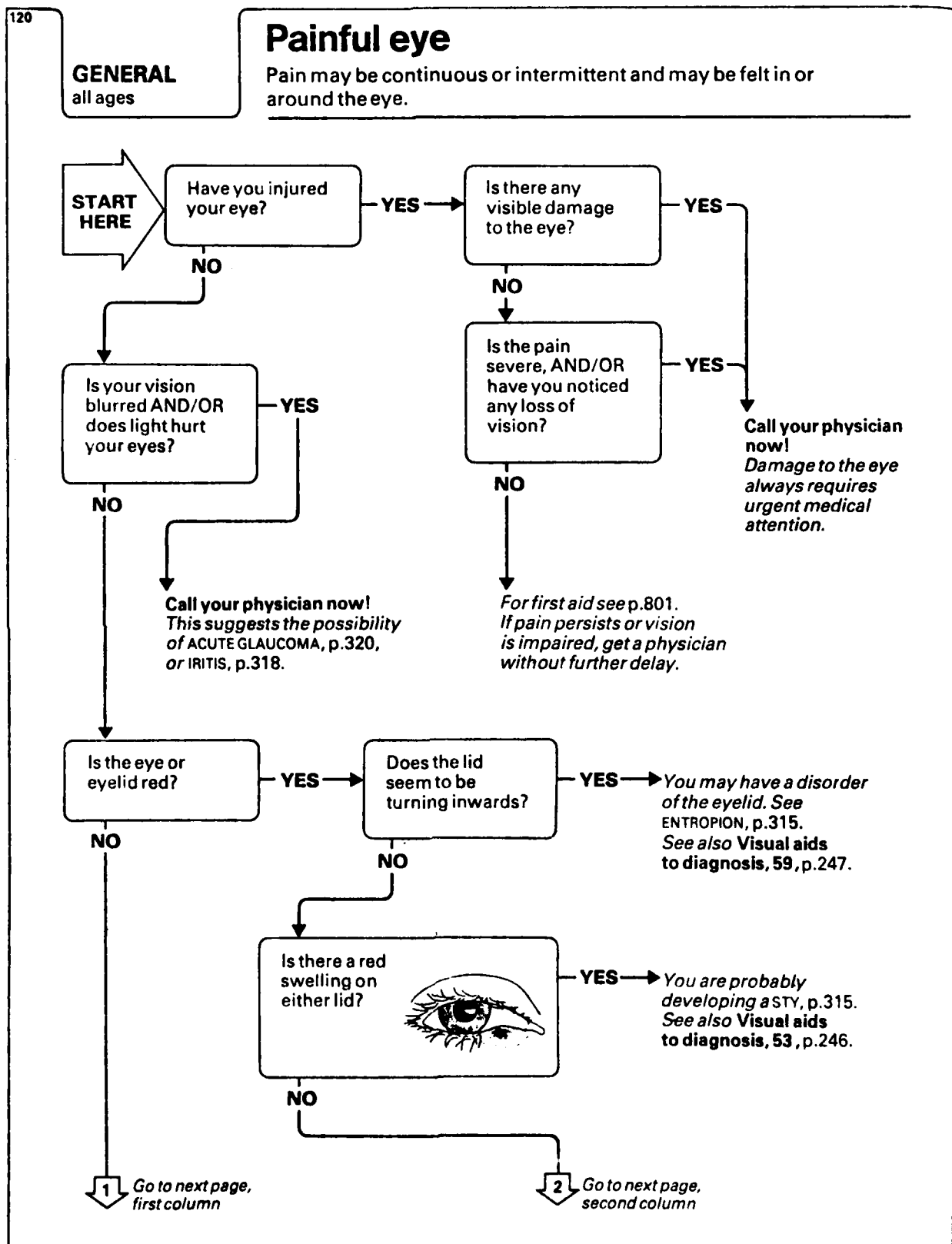
Conclusion

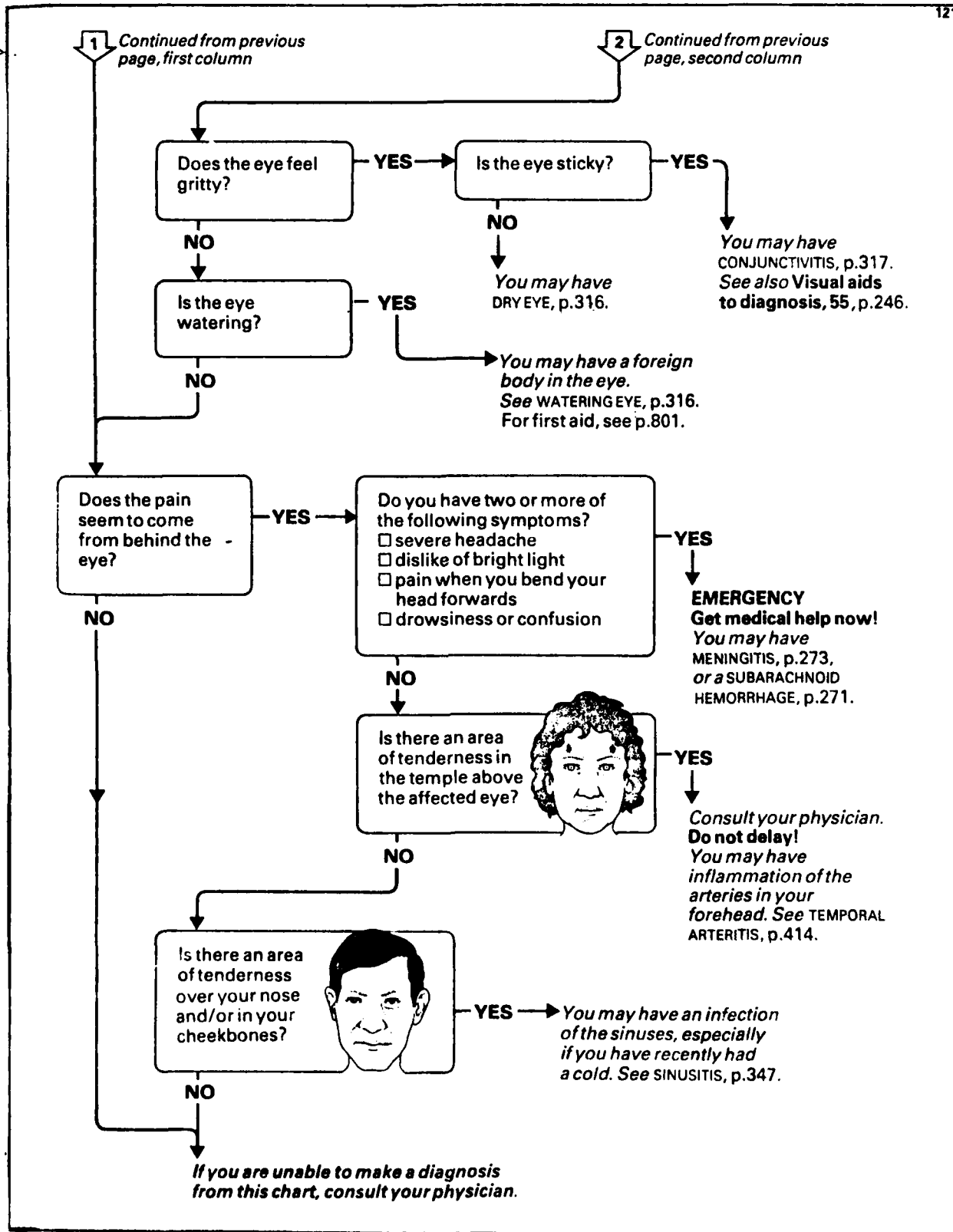
The results of this research effort show that it is possible for medical appointment clerks using a medical diagnosing algorithm to accurately diagnose patients telephoning for an appointment at the Family Practice Clinic at the USAF Medical Center Wright-Patterson. The accuracy level achieved in this research was seventy percent.

This study could be used as the initial ground work for the development of an appointment system whereby patients could be given appointments based on their urgency of need for care.

Further research is needed to determine if similar or better accuracy levels can be achieved using the patient population of other Air Force medical facilities. If an acceptable accuracy level is achieved in these extended studies, the Air Force Medical Service might decide to develop an urgency of need appointment system to assist in alleviating some of the excess demands for medical care placed upon Air Force medical facilities.

Appendix A: Sample of Diagnosing Algorithm Used (1)





Appendix B: Refill Algorithm

Refill

Start >> Do you have any (Go to symptoms)
problems or symptoms (Chart and begin)
that are not being ---Yes-> (determining)
treated by your (chief complaint)
medication?

/

/

No

/

/

Is your prescription (Go to symptoms)
over 6 months old? ---Yes-> (Chart and)
(re-determine)
(complaint)

/

/

No

/

/

Refill

Appendix C: Follow-up Algorithm

Follow-up

Start >> Were you last seen (Go to symptoms)
for your condition --Yes-> (Chart and)
more than 6 months (re-determine)
ago? (chief complaint)

/

/

No

/

/

Did your
provider tell you
to make a follow-up --Yes-> Follow-up
appointment with
him/her?

/

/

No

/

/

Return to symptoms chart
to determine patient's
chief complaint

Appendix D: Data Collection Sheet

Date _____

[illegible]

Appendix E: Accurate Clerk Diagnoses

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : COLD, HAYFEVER
PROVIDER DIAGNOSIS : PHANGNGITIS, CHRONIC ALLG
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#38 OTHER DISEASES OF THE UPPER RESPIRATORY TRACT

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : APR0485

CLERK DIAGNOSIS : FOLLOWUP, TORN LIGAMENT
PROVIDER DIAGNOSIS : FOLLOWUP, TORN LIGAMENT
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0385
APPOINTMENT DATE : APR2385

CLERK DIAGNOSIS : WART REMOVAL
PROVIDER DIAGNOSIS : WART REMOVAL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#65 DISEASES OF THE SKIN AND SUBCUTANEOUS TISSUE

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2185

CLERK DIAGNOSIS : HIGH BLOOD PRESSURE
PROVIDER DIAGNOSIS : HIGH BLOOD PRESSURE
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#25 HYPERTENSIVE HEART DISEASES

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : MAR2585

CLERK DIAGNOSIS : COLD
PROVIDER DIAGNOSIS : UPPER RESPIRATORY INFECT
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#37 ACUTE UPPER RESPIRATORY TRACT INFECTION

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2985

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0285

CLERK DIAGNOSIS : KIDNEY INFECTION
PROVIDER DIAGNOSIS : NEPHRITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#54 DISEASES OF THE KIDNEY AND URETER

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1585

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR1085

CLERK DIAGNOSIS : HEARING LOSS
PROVIDER DIAGNOSIS : BILAT SOM CLEARING,
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#24 DISEASE OF THE EAR AND MASTOID PROCESS

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0585

CLERK DIAGNOSIS : HEARTBURN
PROVIDER DIAGNOSIS : HEARTBURN, OBESITY RELATE
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#45 UPPER GASTRO-INTESTINAL DISEASES EXCEPT GASTRIC & PEPTI
C ULCER

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2285

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FOLLOWUP

AD-A161 705

MEDICAL APPOINTMENT DESK TELEPHONE TRIAGE(U) AIR FORCE
INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYSTEMS
AND LOGISTICS D M WAGNER SEP 85 AFIT/GLN/LSM/855-88

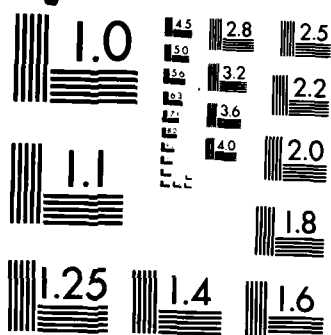
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UNCLASSIFIED

F/G 6/12

NL

											END		
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2185
APPOINTMENT DATE : APR0185

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1085

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : GROIN IRRITATION
PROVIDER DIAGNOSIS : RESBUN NSA DERMATITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#65 DISEASE OF THE SKIN AND SUBCUTANEOUS TISSUE

DATA COLLECTION DATE: MAR2085
APPOINTMENT DATE : APR0385

CLERK DIAGNOSIS : KIDNEY INFECTION
PROVIDER DIAGNOSIS : URINARY TRACT INFECTION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#56 CYSTITIS AND OTHER URINARY DISEASES

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0885

CLERK DIAGNOSIS : FOLLOWUP, HIGH BP
PROVIDER DIAGNOSIS : FOLLOWUP, HIGH BP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2985

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0385
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : FOLLOWUP, BP CHECK
PROVIDER DIAGNOSIS : BP CHECK, FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR0285

CLERK DIAGNOSIS : BASAL CELL CARCINOMIA
PROVIDER DIAGNOSIS : REFR SURG F/ BIOPSY
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#04 MALIGNANT NEOPLASM OF THE SKIN

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : FOLLOWUP, HIGH BP
PROVIDER DIAGNOSIS : FOLLOWUP, HIGH BP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR1185

CLERK DIAGNOSIS : FOLLOWUP, DIABETES
PROVIDER DIAGNOSIS : FOLLOWUP, DIABETES
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : FOLLOWUP, TUMOR REMOVAL
PROVIDER DIAGNOSIS : FOLLOWUP, TUMOR REMOVAL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : MAR2585

CLERK DIAGNOSIS : MIDDLE EAR INFECTION
PROVIDER DIAGNOSIS : ESTRACIAN TUBE INFECTION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#24 DISEASE OF THE EAR AND MASTOID PROCESS

DATA COLLECTION DATE: MAR2185
APPOINTMENT DATE : APR1585

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1585

CLERK DIAGNOSIS : BOIL
PROVIDER DIAGNOSIS : CYST REMOVAL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#12 BENIGN NEOPLASM OF OTHER SITES

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : FOLLOWUP, HIGH BP
PROVIDER DIAGNOSIS : FOLLOWUP, HIGH BP

PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : ARTHRITIS
PROVIDER DIAGNOSIS : ARTHRITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#66 ARTHRITIS

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR1085

CLERK DIAGNOSIS : GASTRITIS
PROVIDER DIAGNOSIS : GASTRITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#45 UPPER GASTRO-INTESTINAL DISEASES EXCEPT GASTRIC & PEPTI
C ULCER

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : MAR2285

CLERK DIAGNOSIS : HEMORRHOIDS
PROVIDER DIAGNOSIS : HEMERRHOIDS, SCHDLD F/ SU
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#49 DISEASES OF THE ANUS

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : MAR2985

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FOLLOWUP, BP CHECK
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0485

CLERK DIAGNOSIS : STRAIN OR SPRAIN
PROVIDER DIAGNOSIS : FALLEN ARCHES
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#77 DISLOCATIONS & OTHER MUSCULO-SKELETAL INJURIES

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : MAR2585

CLERK DIAGNOSIS : SINUSITIS
PROVIDER DIAGNOSIS : UPPER RESPIRATORY INFECTION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#38 OTHER DISEASES OF THE UPPER RESPIRATORY TRACT

DATA COLLECTION DATE: MAR2085
APPOINTMENT DATE : APR0185

CLERK DIAGNOSIS : MUSCLE STRAIN
PROVIDER DIAGNOSIS : MUSCLE SPASM
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#77 DISLOCATION & OTHER MUSCULO-SKELETAL INJURIES
=====

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : BLURRED VISION
PROVIDER DIAGNOSIS : BLURRED VISION, REF OPTOM
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#23 DISEASES OF THE EYE

DATA COLLECTION DATE: APR0385
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : FOLLOWUP, LIVER PROBLEM
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : REFILL, HIGH BLOOD PRESS
PROVIDER DIAGNOSIS : REFILL, HYPERTENSION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1885

APPOINTMENT DATE : MAR2885
CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : REFILL/ GOUT
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : APR0185

CLERK DIAGNOSIS : ARTHRITIS,
PROVIDER DIAGNOSIS : ARTHRITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#66 ARTHRITIS

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : APR0185

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : MAY0185

CLERK DIAGNOSIS : FOLLOWUP, BP CHECK

PROVIDER DIAGNOSIS : FOLLOWUP, BP CHECK
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : FOLLOWUP, ANEMIA
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR0385

CLERK DIAGNOSIS : WANTS X-RAYS READ
PROVIDER DIAGNOSIS : X-RAY READ, NO ABNORMAL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : APR0485

CLERK DIAGNOSIS : CARPAL TUNNEL SYNDROME
PROVIDER DIAGNOSIS : BILAT CARPAL TUNNEL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#23 DISEASES OF THE EYE

DATA COLLECTION DATE: MAR2185
APPOINTMENT DATE : APR0385

CLERK DIAGNOSIS : MUSCLE STRAIN
PROVIDER DIAGNOSIS : STRAIN IN HAND/FATIGUE
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#77 DISLOCATION & OTHER MUSCULO-SKELETAL INJURIES

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR2685

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR1085

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : FOLLOWUP BP AND THYROID
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR1985

CLERK DIAGNOSIS : RECTAL RASH
PROVIDER DIAGNOSIS : TINEA CRURIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#49 DISEASES OF THE ANUS

DATA COLLECTION DATE: MAR2085
APPOINTMENT DATE : APR0285

CLERK DIAGNOSIS : VD WARTS
PROVIDER DIAGNOSIS : REMOVE WARTS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#58 DISEASE OF THE MALE REPRODUCTIVE SYSTEM

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : SINUSITIS
PROVIDER DIAGNOSIS : SINUSITUS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#38 OTHER DISEASES OF THE UPPER RESPIRATORY TRACT

DATA COLLECTION DATE: APR0185

APPOINTMENT DATE : APR0585
CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : TENDONITIS
PROVIDER DIAGNOSIS : TENDONITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#69 OTHER DISEASE OF THE MUSCULO-SKELETAL SYSTEM

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : MAR2585

CLERK DIAGNOSIS : INFLUENZA
PROVIDER DIAGNOSIS : UPPER RESPIRATORY INFEC
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#37 ACUTE UPPER RESPIRATORY INFECTION & INFLUENZA

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1285

CLERK DIAGNOSIS : MUSCLE STRAIN
PROVIDER DIAGNOSIS : MUSCLE STRAIN
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#77 DISLOCATIONS AND OTHER MUSCULO-SKELETAL INJURIES

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1585

CLERK DIAGNOSIS : CATARACT
PROVIDER DIAGNOSIS : BILATERAL CATARACT
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#23 DISEASES OF THE EYE

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : REFILL

PROVIDER DIAGNOSIS : REFILL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

Appendix E: Inaccurate Clerk Diagnoses

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2985

CLERK DIAGNOSIS : GOUT
PROVIDER DIAGNOSIS : OSTEOPOROSIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#68 DISEASES OF THE BONE AND CARTILAGE

DATA COLLECTION DATE: MAR2085
APPOINTMENT DATE : APR0285

CLERK DIAGNOSIS : ALGORITHM FAILED
PROVIDER DIAGNOSIS : FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2185
APPOINTMENT DATE : MAR2585

CLERK DIAGNOSIS : MENINGITIS
PROVIDER DIAGNOSIS : STRAINED TORTICALLIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#77 DISLOCATIONS AND OTHER MUSCULO-SKELETAL INJURIES

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : MAR2785

CLERK DIAGNOSIS : PATIENT UNRESPONSIVE
PROVIDER DIAGNOSIS : VIRAIL SYNDROME BURSITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#66 ARTHRITIS

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1585

CLERK DIAGNOSIS : CHEST PAIN, ALGOR.FAILED
PROVIDER DIAGNOSIS : GALLSTONES
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#52 DISEASES OF THE GALLBLADDER AND BILE DUCT

DATA COLLECTION DATE: MAR2185
APPOINTMENT DATE : APR0185

CLERK DIAGNOSIS : DIABETES
PROVIDER DIAGNOSIS : NOT DIABETES, SCHED FU
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
DRG NOT DETERMINABLE WITHOUT DIAGNOSIS

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0585

CLERK DIAGNOSIS : ALGORITHM FAILED
PROVIDER DIAGNOSIS : BLEPHORITIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#23 DISEASES OF THE EYE

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : HYPERTHYROIDISM
PROVIDER DIAGNOSIS : NO HYPERTHYROID, OBESITY
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#15 NUTRITIONAL AND OTHER METABOLIC DISEASES

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : APR0185

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : PHYSICAL, ANXIETY
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#18 NEUROSES

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR1885

CLERK DIAGNOSIS : CORNS OR WARTS
PROVIDER DIAGNOSIS : STERILIZATION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

#83 SPECIAL ADMISSIONS AND EXAMINATIONS W/O REPORTED DIAGNOSES

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : ARTHRITIS
PROVIDER DIAGNOSIS : URINARY TRACT INFECTION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#56 CYSTITIS AND OTHER URINARY DISEASES

DATA COLLECTION DATE: MAR2085
APPOINTMENT DATE : APR0285

CLERK DIAGNOSIS : ALGORITHM FAILED
PROVIDER DIAGNOSIS : HEARING LOSS, REF AUDIOL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#24 DISEASE OF THE EAR AND MASTOID PROCESS

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : BRONCHITIS
PROVIDER DIAGNOSIS : DIABETES TESTING
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#14 DIABETES

DATA COLLECTION DATE: MAR2185
APPOINTMENT DATE : APR0385

CLERK DIAGNOSIS : HEMORRHOID
PROVIDER DIAGNOSIS : HERNIA, REFERRAL TO SUR
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#47 HERNIA OF THE ABDOMINAL CAVITY

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0485

CLERK DIAGNOSIS : ARTHRITIS
PROVIDER DIAGNOSIS : OSTEOPOROSIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#69 OTHER DISEASE OF THE MUSCULO-SKELETAL SYSTEM

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR0985

CLERK DIAGNOSIS : ALGORITHM FAILED
PROVIDER DIAGNOSIS : NO DIAGNOSIS, RESCHEDULED
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
DRG DETERMINATION REQUIRES A DIAGNOSIS

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : ALGORITHM FAILED
PROVIDER DIAGNOSIS : MULTIPLE SCLEROSIS
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#21 DISEASES OF THE CENTRAL NERVOUS SYSTEM

DATA COLLECTION DATE: MAR1885
APPOINTMENT DATE : MAR2885

CLERK DIAGNOSIS : FOLLOWUP
PROVIDER DIAGNOSIS : FILL OUT LICENSE FORM
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2285
APPOINTMENT DATE : APR0285

CLERK DIAGNOSIS : HEMORRHOIDS
PROVIDER DIAGNOSIS : NO HEMORRHOIDS, SCHDL FU
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
DRG DETERMINATION REQUIRES A DIAGNOSIS

DATA COLLECTION DATE: APR0185

APPOINTMENT DATE : APR0285
CLERK DIAGNOSIS : PINCHED NERVE
PROVIDER DIAGNOSIS : CERVICAL LESION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#59 DISEASE OF THE FEMALE REPRODUCTIVE SYSTEM

DATA COLLECTION DATE: APR0185
APPOINTMENT DATE : APR1585

CLERK DIAGNOSIS : TENDONITIS
PROVIDER DIAGNOSIS : NO DIAG, 2 MO FOLLOWUP
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
DRG DETERMINATION REQUIRES A DIAGNOSIS

DATA COLLECTION DATE: MAR2785
APPOINTMENT DATE : APR1785

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : EKG F/ CIV WEIGHT LOSS CL
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR2585
APPOINTMENT DATE : APR0585

CLERK DIAGNOSIS : PULMINARY EDEMA
PROVIDER DIAGNOSIS : SINUS CONDITION
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#38 OTHER DISEASE OF THE UPPER RESPIRATORY TRACT

DATA COLLECTION DATE: APR0285
APPOINTMENT DATE : APR3085

CLERK DIAGNOSIS : REFILL
PROVIDER DIAGNOSIS : FORGETFULNES, SCHED FU
PROVIDERS' MAJOR DIAGNOSIS CATEGORY

DATA COLLECTION DATE: MAR1985
APPOINTMENT DATE : APR0385

CLERK DIAGNOSIS : HODGKINS,LYMPH
PROVIDER DIAGNOSIS : MUSCLE STRAIN
PROVIDERS' MAJOR DIAGNOSIS CATEGORY
#77 DISLOCATIONS AND OTHER MUSCULO-SKELETAL INJURIES

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2 The demand for medical care frequently exceeds the ability of Air Force medical facilities to provide it. Appointment systems do little to alleviate this problem. One way to reduce the problem might be to provide medical appointments on the basis of urgency of need for care, rather than on a first-come, first-served basis as in current systems.

The first step in developing such a system would be to determine if medical appointment clerks could accurately diagnose patients telephoning for an appointment. This thesis explored the possibility of such a system by having medical appointment clerks use a medical diagnosing algorithm to diagnose patients calling for an appointment at the Family Practice Clinic of the Air Force Medical Center at Wright-Patterson AFB Ohio.

The the experiment showed that it was possible for appointment clerks to accurately diagnose fifty-nine out of eighty-four patients. *Keywords:*

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